Impact of Agricultural Non-Point-Source Pollution on Water Quality

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RESEARCH OBJECTIVES

Non-point-source (NPS) water pollution is now recognized as the most significant remaining source of water quality impairment in the United States. NPS pollution is a worldwide problem and impacts drinking water and quality of life in both industrial and nonindustrial societies. NPS pollution, unlike pollution from industrial or sewage treatment plants, comes from diffuse sources that are hard to identify and are poorly understood and characterized. Agriculture is a major source of NPS pollution, but the nature, character, and impact of this pollution is largely unknown.

We are currently conducting an ecosystem-level study on the San Joaquin River in the Central Valley of California, examining how NPS discharge impacts water quality. The primary objective is to understand how nutrient and sediment-laden drainage from agriculture influences primary productivity (algal growth) in the river, and how algal growth produces secondary impacts on water quality and fish habitats in the river and connecting delta ecosystem. We are also examining how changing agricultural practices, referred to as best management practices (BMPs), will influence productivity and water quality in riverine ecosystems.

APPROACH

To understand the interaction between NPS pollution, algae growth rate, and algae biomass carrying capacity, we are measuring a complete mass balance on algae and nutrients over a 110 mile reach of the San Joaquin River. Simultaneous collection of water quality and biological data at 21 sites in the watershed develops an instantaneous "snapshot" or profile of algae and nutrients in the river. Seasonal and diurnal changes in algal productivity are studied, using continuously deployed chlorophyll measuring devices and field experiments in which individual algal blooms are tracked and characterized. Specific tributaries and "hot spots" for algal growth are subject to focused studies to answer basic scientific and engineering questions concerning environmental conditions limiting algal growth. The installation and operation of a network of 51 stations, for the continuous measurement of flow and salt concentration in the main stem of the river and the tributaries, provides the final piece of the puzzle that allows us to develop a complete mass balance on algae and nutrients in this ecosystem.

ACCOMPLISHMENTS

This year is the first of a three-year study. Collection of water quality and biological data has begun. The continuous-flow and water-quality monitoring network is almost complete. Studies of bloom dynamics and individual tributaries are in progress.

SIGNIFICANCE OF FINDINGS

Initial studies have already contributed to our understanding of NPS pollution in the San Joaquin Valley. Studies of algal growth and water quality at previously uncharacterized tributaries have raised new questions concerning our understanding of algal growth dynamics in this river. Such studies have challenged assumptions included in water quality models used by state agencies to manage water quality in this severely impacted water body.

RELATED PUBLICATIONS

Stringfellow, W.T., and N.W.T. Quinn, Discriminating between west-side sources of nutrients and organic carbon contributing to algal growth and oxygen demand in the San Joaquin River. CALFED Bay-Delta Program, Sacramento, California; Berkeley Lab Report LBNL-51166, 2002.

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